(102)
6,087,261
6,008,514
IEDM 96

What is claimed is:

Sub A1

1. A method for forming a semiconductor device having a laminated structure of a dielectric film made from a metal oxide which is formed on a surface of a substrate and CVD high melting point metal nitride film directly formed thereover, wherein said dielectric film is directly formed on said dielectric film by introducing a source gas containing said high melting point metal into a chamber in which said substrate is contained, said method comprising a step of treating said substrate in said chamber with at least either one of a gas non-reactive with respect to metal oxide contained in said dielectric film and NH_3 gas with keeping said temperature of said substrate at a prescribed temperature, before said source gas containing said high melting point metal is introduced into said chamber.

2. A method for forming a semiconductor device according to claim 1, wherein said treating step serving as a flow stabilizing step for stabilize a gas flow used in said chamber.

3. A method for forming a semiconductor device according to claim 2, wherein said non-reactive gas is introduced in said flow stabilizing step.

4. A method for forming a semiconductor device according to claim 1, wherein said treating step comprising a step for heating said substrate and said flow stabilizing step which is performed after said heating step has been completed.

5. A method for forming a semiconductor device according to claim 4, wherein said NH_3 gas is introduced into said chamber in said heating step.

6. A method for forming a semiconductor device according to claim 5, wherein said NH_3 gas has NH_3 atmosphere of no greater than 1.0 Torr and no less than 0.1 Torr.

7. A method for forming a semiconductor device according to claim 5, wherein said non-reactive gas and said NH_3 gas are introduced into said chamber in said flow stabilizing step.

8. A method for forming a semiconductor device having a laminated structure of a dielectric made from a metal oxide and CVD high melting point metal nitride film formed thereover, wherein said dielectric film is directly formed on said dielectric film by introducing a source gas containing said high melting point metal into a chamber in which said substrate is contained, said method comprising:

heating of a substrate onto which said dielectric film is formed to a prescribed temperature in an NH_3 atmosphere of no greater than 1.0 Torr and no less than 0.1 Torr before the introduction of said source gas containing said high melting point metal.

9. A method for manufacturing a semiconductor device according to claim 8, said method comprising:

a step of heating a substrate to a prescribed temperature; and

a step of maintaining said substrate temperature as a gas non-reactive with respect to tantalum oxide is introduced and the flow thereof is stabilized,

said steps being performed before the introduction of a source gas containing a high melting point metal, and NH_3 gas being introduced in either said substrate heating step or said flow stabilization step.

10. A method for manufacturing a semiconductor device according to claim 9, said method further comprising;

a step of introducing a source gas containing a high melting point metal, and growing a CVD high melting point metal nitride film after performing said flow stabilization step: and

a step of raising the partial pressure of the NH_3 gas in the latter half of the CVD film growing step so that annealing is done by the NH_3 gas.

11. A method for manufacturing a semiconductor device according to claim 1, wherein said method further comprising;

a step, performed before said CVD high melting point metal nitride film

forming step, of heating a substrate onto which said dielectric film is formed, in said chamber by introducing therein said non-reactive gas; and

a step of forming said high melting point metal nitride film on said dielectric film by introducing a mixtured gas comprising said NH_3 gas, said non-reactive gas the amount of which is identical to or relatively larger than that of said NH_3 gas and said source gas containing said high melting point metal the amount of which being relatively smaller than those of said NH_3 gas and said non-reactive gas.

12. A method for forming a semiconductor device according to claim 11, wherein said method further comprising a step of a gas purging operation in an inside of said said chamber by supplying said NH_3 gas and said non-reactive gas into said chamber with stopping a supply of said source gas containing said high melting point metal thereinto.

13. A method for forming a semiconductor device according to claim 1, wherein said dielectric film is a tantalum oxide (Ta_2O_5) film.

14. A method for forming a semiconductor device according to claim 1, wherein said substrate is heated to a temperature of at least 400℃ and no greater than 700℃.

15. A method for forming a semiconductor device according to claim 1, wherein said non-reactive gas is one gas selected from a rarified gas including nitrogen, argon, hydrogen gas, or a mixture of these gases.

16. A method for forming a semiconductor device according to claim 1, wherein said high melting point metal nitride film is TiN film.

17. A method for forming a semiconductor device according to claim 16, wherein said source gas containing titanium as said high melting point metal, is a gas selected from the group consisting of titanium tetrachloride ($TiCl_4$), tetrakis dimethyl amino titanium (TDMAT), tetrakis diethyl amino titanium (TDEAT) is used as the source gas containing titanium.

18. A method for forming a semiconductor device according to claim 1,

wherein said high melting point metal nitride film is a WN film, and wherein WF_6 gas is introduced as a source gas containing tungsten.

19. A method for manufacturing a semiconductor device according to claim 1, wherein said semiconductor device has a capacitive element, a dielectric film of which is a capacitive insulation film, a CVD high melting point metal nitride film serving as a protective film disposed between said capacitive insulation film and said capacitive element.

20. A method for manufacturing a semiconductor device according to claim 1, wherein said semiconductor device has a MOSFET, the gate insulation film of which is a dielectric film, and wherein said CVD high melting point metal nitride layer is the lowermost layer of the laminated gate electrode layer formed on said gate insulation film.

A2 Cont

Add A3

add E17